

General Disclaimer

One or more of the Following Statements may affect this Document

- This document has been reproduced from the best copy furnished by the organizational source. It is being released in the interest of making available as much information as possible.
- This document may contain data, which exceeds the sheet parameters. It was furnished in this condition by the organizational source and is the best copy available.
- This document may contain tone-on-tone or color graphs, charts and/or pictures, which have been reproduced in black and white.
- This document is paginated as submitted by the original source.
- Portions of this document are not fully legible due to the historical nature of some of the material. However, it is the best reproduction available from the original submission.



John F. Kennedy Space Center's Wireless Hang Angle Instrumentation System



The National Aeronautics and Space Administration (NASA) seeks partners interested in the commercial application of the Wireless Hang Angle Instrumentation System. The technology is a high-precision, wireless inclinometer. The system was designed for monitoring the suspension angle of the Orbiter vehicle during loading onto the Solid Rocket Boosters of the Space Shuttle. Originally, operators manually measured the alignment of the Orbiter with a hand-held inclinometer on a nonrigid surface. The measurement was open to interpretation by the loader. If the Orbiter is misaligned, it can crush ball joints and delay the loading while repairs are made. With this system, the Orbiter can be loaded without damage and without manual measurement.

BENEFITS

- **Highly Precise:** precise measurements down to 15 arc seconds. Ultra-low thermal expansion mounting bracket minimizes errors that can result from changes in temperature.
- **Safe:** Removes human element from hazardous areas. Does not interfere with other critical systems. Built-in redundancy transmits with no loss of information.
- **Low power:** Unique power management scheme allows for thousands of readings up to 300 ft with four AA batteries.
- **Small and lightweight:** The wireless measurement system has dimensions of 4" x 3" x 2" and weighs less than 20 lb.
- **Adaptable:** Easily modified to meet customer needs.

technology ■ opportunity

APPLICATIONS

- Aerospace: Precision motion control, wind tunnel studies, laser leveling.
- Precision Equipment Monitoring: Wind turbine vibration monitoring and turbine generator alignment.
- Geophysics: Volcanic monitoring and crustal deformation.
- High-Energy Physics: Beam alignment.

TECHNOLOGY STATUS

- ☐ Patent pending
- ☐ U.S. patent
- ☐ Copyrighted
- ☒ Available to license
- ☐ Available for no-cost transfer
- ☐ Seeking industry partner for further codevelopment

Technology Details

The technology is a field-tested, wireless tiltmeter that was designed to measure the suspension angle of an Orbiter vehicle while it is being loaded on booster rockets to prevent damage to the vehicle and rockets. It is composed of a measurement unit attached to the Orbiter and a hand-held unit that allows operators to read the angle. The measurement unit has three main parts: redundant accelerometers to measure the angle, a wireless transceiver to communicate with the hand-held unit, and an attachment piece (made of material with a low thermal-expansion coefficient) that connects the inclinometer to the measured surface. The hand-held unit consists of a wireless transceiver and a read-out screen. The wireless protocol is proprietary to NASA and is based on technology previously patented.

Partnership Opportunities

All NASA licenses are individually negotiated with the prospective licensee, and each license contains terms concerning commercialization (practical application), license duration, royalties, and periodic reporting. NASA patent licenses may be exclusive, partially exclusive, or nonexclusive. If your company is interested in the new Wireless Hang Angle Instrumentation System technology, or if you desire additional information, please reference Case Number KSC-12751 and contact:

Jeff Kohler
Innovative Partnerships Program
Mail Code: KT-A2
Kennedy Space Center, FL 32899
Telephone: (321) 861-7158
Fax: (321) 867-2050
jeffrey.a.kohler@nasa.gov

| REPORT DOCUMENTATION PAGE | | | | Form Approved OMB No. 0704-0188 | |
|--|-------------|------------------------|---|---|---|
| <p>The public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing the burden, to Department of Defense, Washington Headquarters Services, Directorate for Information Operations and Reports (0704-0188), 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.</p> <p>PLEASE DO NOT RETURN YOUR FORM TO THE ABOVE ADDRESS.</p> | | | | | |
| 1. REPORT DATE (DD-MM-YYYY) 2009 | | 2. REPORT TYPE TOPS | | 3. DATES COVERED (From - To) 2009 | |
| 4. TITLE AND SUBTITLE John F. Kennedy Space Center's Wireless Hang Angle Instrumentation System | | | | 5a. CONTRACT NUMBER NAS10-03006 | |
| | | | | 5b. GRANT NUMBER | |
| | | | | 5c. PROGRAM ELEMENT NUMBER KSC-12751 | |
| 6. AUTHOR(S) Jeff Kohler | | | | 5d. PROJECT NUMBER | |
| | | | | 5e. TASK NUMBER | |
| | | | | 5f. WORK UNIT NUMBER | |
| 7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) ASRC Aerospace Kennedy Space Center FL 32815 | | | | 8. PERFORMING ORGANIZATION REPORT NUMBER | |
| 9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) | | | | 10. SPONSOR/MONITOR'S ACRONYM(S) | |
| | | | | 11. SPONSOR/MONITOR'S REPORT NUMBER(S) | |
| 12. DISTRIBUTION/AVAILABILITY STATEMENT Public Domain | | | | | |
| 13. SUPPLEMENTARY NOTES | | | | | |
| 14. ABSTRACT <p>The technology is a high-precision, wireless inclinometer. The system was designed for monitoring the suspension angle of the Orbiter vehicle during loading onto the Solid Rocket Boosters of the Space Shuttle. Originally, operators manually measured the alignment of the Orbiter with a hand-held inclinometer on a nonrigid surface. The measurement was open to interpretation by the loader. If the Orbiter is misaligned, it can crush ball joints and delay the loading while repairs are made. With this system, the Orbiter can be loaded without damage and without manual measurement.</p> | | | | | |
| 15. SUBJECT TERMS | | | | | |
| 16. SECURITY CLASSIFICATION OF: | | | 17. LIMITATION OF ABSTRACT UU | 18. NUMBER OF PAGES 1 | 19a. NAME OF RESPONSIBLE PERSON Jeff Kohler |
| a. REPORT U | b. ABSTRACT | c. THIS PAGE | | | 19b. TELEPHONE NUMBER (Include area code) 321-861-7158 |